COMP 110/L Lecture 16

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Some slides are adapted from Dr. Kyle Dewey

Outline

- Multidimensional arrays
- JUnit `fail()`

Multidimensional Arrays

Recap - Arrays

Arrays are fixed-length sequences
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```
new char[]{'a', 'b', 'c'}

new int[]{1, 2, 3}

new String[]{"foo", "bar"}

new double[]{1.2, 3.4}
```

Motivations

Thus far, you have used one-dimensional arrays to model linear collections of elements. You can use a two-dimensional array to represent a matrix or a table. For example, the following table that describes the distances between the cities can be represented using a two-dimensional array.

Distance Table (in miles)

	Chicago	Boston	New York	Atlanta	Miami	Dallas	Houston
Chicago	0	983	787	714	1375	967	1087
Boston	983	0	214	1102	1763	1723	1842
New York	787	214	0	888	1549	1548	1627
Atlanta	714	1102	888	0	661	781	810
Miami	1375	1763	1549	661	0	1426	1187
Dallas	967	1723	1548	781	1426	0	239
Houston	1087	1842	1627	810	1187	239	0

Motivations

```
double[][] distances = {
   {0, 983, 787, 714, 1375, 967, 1087},
   {983, 0, 214, 1102, 1763, 1723, 1842},
   {787, 214, 0, 888, 1549, 1548, 1627},
   {714, 1102, 888, 0, 661, 781, 810},
   {1375, 1763, 1549, 661, 0, 1426, 1187},
   {967, 1723, 1548, 781, 1426, 0, 239},
   {1087, 1842, 1627, 810, 1187, 239, 0},
};
```

Multidimensional Arrays

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             new int[]{6},
             new int[0],
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Corresponding type: `int[][]`

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Accessing Columns

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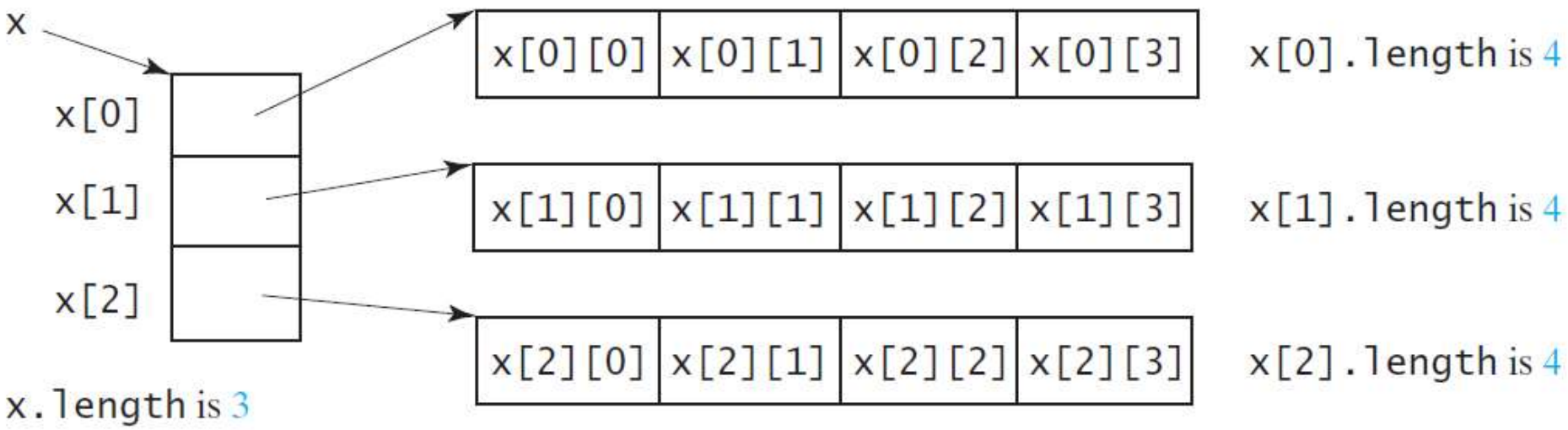
int[][] array = ...;
int[] row = array[0];
int columnElement = row[5];
```

```
int[][] array = ...;
int columnElement = array[0][5];
```

	Column 0	Column 1	Column 2
Row 0	x[0][0]	x[0][1]	x[0][2]
Row 1	x[1][0]	x[1][1]	x[1][2]
Row 2	x[2][0]	x[2][1]	x[2][2]

Lengths of Two-dimensional Arrays

```
int[][] x = new int[3][4];
```



Lengths of Two-dimensional Arrays, cont.

```
int[][] array = {
  {1, 2, 3},
  {4, 5, 6},
  {7, 8, 9},
  {10, 11, 12}
};
```

array.length

array[0].length

array[1].length

array[2].length

array[3].length

array[4].length ArrayIndexOutOfBoundsException

Ragged Arrays

Each row in a two-dimensional array is itself an array. So, the rows can have different lengths. Such an array is known as *a ragged array*.

For example,

```
int[][] matrix = {
  {1, 2, 3, 4, 5},
  {2, 3, 4, 5},
  {3, 4, 5},
  {4, 5},
  {5}
};
```

```
matrix.length is 5
matrix[0].length is 5
matrix[1].length is 4
matrix[2].length is 3
matrix[3].length is 2
matrix[4].length is 1
```

Example:

`AccessTwoDimensionalElement.java`

More 2D Array Examples

- `PrintRow2D.java`
- `PrintCol2D.java`

JUnit fail()

fail()

Triggers immediate test failure

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```
Import static org.junit.Assert.fail;
```

fail()

Triggers immediate test failure

```
import static org.junit.Assert.fail;


    @Test
    public void testSomething() {
      if(someFailureCondition) {
        fail();
      }
    }
```

fail() Utility

- Some test failures cannot be easily phrased as one value equals another value
- Occasionally more convenient
- We can define our own `assertEquals()` and `assertArrayEquals()` using `fail()`

Some cases where it is useful:

1- mark a test that is incomplete, so it fails and warns you until you can finish it

2- making sure an exception is thrown:

There are three states that your test case can end up in
Passed: The function under test executed successfully and returned data as expected
Not Passed: The function under test executed successfully but the returned data was not as expected
Failed: The function did not execute successfully and this was not intended (Unlike negative test cases that expect a exception to occur).

If you are using eclipse there three states are indicated by a **Green**, **Blue** and **red** marker respectively.

We can use the fail operation for the third scenario.
e.g.:

public Integer add(integer a, Integer b) { return new Integer(a.intValue() + b.intValue())}

Passed Case: a = new Interger(1), b= new Integer(2) and the function returned 3
Not Passed Case: a = new Interger(1), b= new Integer(2) and the function returned any value other than 3
Failed Case: a = null , b = null and the function throws a NullPointerException

Example

- `FailExample.java`
- `FailExampleTest.java`